Foreign aid and growth

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Abstract

Burnside and Dollar (2000) (BD) ignite a policy debate by claiming that foreign aid works only in good policy environments. This result, however, has been criticized by a number of studies on numerous statistical grounds concluding that the BD result is too fragile. I revisit the aid-growth relationship using Bayesian Model Averaging techniques to account for uncertainty issues regarding model specification. I find that the data evidence does not support the claim that aid works only in good policy environments. My analysis also suggests that aid flows are not very effective in boosting growth regardless of the quality of the policy environment.

1. Introduction

Aid-growth relationship is one of politically-charged topics in the economic growth literature, as not only could donor countries potentially use aid to further some political and strategic goals, but also they are accountable for the allocation of limited resources paid for by their taxpayers. The literature on the efficacy foreign aid, however, is far from settled. The importance of the answer to the question of the effectiveness of foreign aid mainly stems from the fact that it has practical implications in the allocation of aid resources. For instance, are selectivity and conditionality justified in the allocation of aid resources? That is, what are (or should be) the consequences of the relationship between aid and growth on the management of aid flows? In this paper, I revisit this relationship and try to shed some light on the current policy debates on the management of aid flows.

Empirical studies[1] on the subject have come up with a range of answers for the relationship between aid and growth. Boone (1996) finds a negative relationship between aid and growth refueling the discussions of aid efficacy. He concludes that foreign aid seems to finance consumption rather than boosting growth in the recipient countries. Burnside and Dollar (2000), Burnside and Dollar (2004), Collier and Dollar (2002) find that aid efficacy is closely related to the macroeconomic policies followed by the country in question. Their analyses indicate that foreign aid is more effective in boosting growth in countries with better macroeconomic policies as opposed to countries with "bad" policies. Hansen and Tarp (2001) as well as McPherson (2000), Dalgaard and Hansen (2005), Dayton-Johnson and Hoddinott (2003), Guillaumont and Chauvet (2001), Lensink and White (1999), Lu and Ram (2001), Akhand and Gupta (2002) and Easterly et al. (2004), to name a few, however, oppose these results on statistical grounds and provide evidence in favor of the hypothesis that aid raises growth regardless of the quality of the policy environment.

The fragility of the Burnside and Dollar (2000) (BD hereinafter) results to different datasets, estimation methods, and even to different definitions of aid and policy measures have been shown (Easterly et al. (2004).) In this paper, I essentially check the sensitivity of the BD results to different model specifications. I utilize Bayesian Model Averaging (BMA hereinafter) techniques to address and tackle uncertainty issues regarding model specification. That is, do the BD results highly depend on the set of control variables used in the estimations? BMA is a statistically appealing technique that has been drawing more attention particularly with the advancement of computational power and techniques.

When I employ BMA techniques to take into account uncertainty issues regarding model specification, I find that the coefficient of the interaction term between aid and policies is too sensitive to the model specification. Its posterior standard

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[1]For a literature review see Dalgaard et al. (2004).

deviation is too great relative to its mean and, hence, "insignificant." In other words, the data evidence does not support the hypothesis that aid works in good policy environments. This is an important result considering that conditionality and selectivity have tremendous effect on the behavior of international financial institutions and donors. This behavior, however, may not be supported by the data.

The paper is organized as follows. Section 2 describes some plausible theoretical channels through which aid impacts growth. I explain the methodology in Section 3 and report and discuss results in Section 4. Finally, Section 5 concludes.

2. Theory

The standard theoretical model in the literature to investigate the relationship between aid and growth has been the two-gap model of Chenery and Strout (1966). The gaps referred to in the model are the differences between: i) domestic savings and the necessary level of investment to achieve a certain rate of growth; ii) foreign exchange receipts and the level of imports required to reach a certain level of production. The two-gap model has been extended into three-gap model by Bacha (1990) to include the government's fiscal position as another possible gap. It is assumed that at any point given in time at least one of the gaps is binding. For instance, if we assume that domestic savings-investment gap is binding, then foreign aid fill the gap and help the economy grow at a higher rate. Obviously, this conclusion is based on the premise that foreign aid actually finances investment rather than consumption and investment is productive. In order for foreign aid to be channeled into investment, the incentives to invest as opposed to consume must be there. As Easterly (2003) puts it, to have a positive link between aid and economic growth, foreign aid must go into investment and that investment must be productive. Conceivably, the degree of the efficacy of foreign aid highly depends on the extent to which the above assumptions hold.

Another problem with the two-gap model is the Leontief-style production function. More recent models of aid consider Solow-type growth models with Cobb-Douglas production function. The Solow model, however, does not offer a stable, linear relationship between aid and growth. As an alternative to the neoclassical growth models endogenous growth models draw attention, which take into account intermediate goods, social and institutional factor as well as more traditional inputs. Some social, institutional and environmental factors are controlled for in the empirical studies as they potentially shift the production function (Hall and Jones (1999).)

Theoretically, foreign aid might have effects on growth similar to the effects of natural resources. One of these channels through which aid can have impact on economic growth is its impact on political institutions. Foreign aid can undermine democratic process as it reduces the accountability of a government. If the

government relies on tax receipts as opposed to aid, it must be responsive to the demands by the citizens. By eliminating this part of the process, aid can deteriorate institutions. Poor institutions are associated with poor macroeconomic policies, which, in turn, hamper growth.

Unrequited aid flows can generate so-called "the transfer paradox." That is, theoretically, aid flows can leave the country worse off than before. This is closely related to the "Dutch disease effect" of aid flows and might prevail as follows. Foreign aid very generally accrues to the public sector and the economic impact of aid flows highly depends on what the government does with aid. If either the public or the private sector spends the gift on imported goods, there will not be any macroeconomic effects. The government can possibly transfer the aid receipts to the private sector directly or through tax cuts, or in the form of increased expenditure. Regardless of the form, it is very likely that in response to the aid flows domestic demand will rise. Unless there is considerable excess supply in the economy, real exchange rate or the prices of domestically produced goods and services must increase in the short run.

The medium-run effects, however, depend on the supply side response. The response of the supply side is determined by how aid inflows are utilized to build on the productive capacity of the economy and how the supply side responds to those changes. One of the possible scenarios is that the excess demand in the non-tradable sector is met by attracting some labor and capital from the export sector. The inter-sectoral reallocation of resources away from the export into non-tradable sector results in a shrinking export sector. This hurts the growth prospects as the traditional export sector is by and large characterized by relatively high productivity gains. Also, if the resulting expansion in the sector is strong relative to the growth in domestic demand, the prices of non-tradables fall. This generates the possibility that the real income may go down for a small open economy, if the prices fall down enough. This phenomenon is called "the transfer paradox."

3. Methodology

Uncertainty issues regarding model specification is an important problem in the empirical growth literature and have been acknowledged and looked into by Brock and Durlauf (2001), Brock et al. (2003), and Doppelhofer et al. (2004), to name a few. The particular context I am interested in obviously is not immune to this problem. As Easterly (2003) points out

> ...These papers conduct variations on the Burnside and Dollar specification (some of which had already figured in the earlier literature), introducing variables such as aid squared, terms of trade shocks, variability of agricultural output and exports and even such complicated terms as an interactive term combining aid with terms of trade shocks. Some of these papers confirm the message of Burnside and Dollar that aid only works in a good policy environment, while others find that when particular variables are added, the coefficient on the interaction between

aid and policy becomes near-zero and/or statistically insignificant. This literature has limitations: how to choose the appropriate specification without guidance from theory, which often means there are more plausible right-hand side variables than there are data points in the sample...

In order to tackle the uncertainty issues regarding model specification, I closely follow Eris (2004) which draws from Brock et al. (2003), and Doppelhofer et al. (2004). I employ BMA techniques to average across all possible models rather than specifying and estimating one or a small set of models. BMA is a statistically coherent way to account for model uncertainty based on the premise that the posterior distribution of a quantity of interest conditional on the observed data and the class of models is the weighted average of the posterior distributions of that quantity by posterior model probabilities under each model considered. That is,

$$\mu(\Delta \mid D) = \sum_{k} \mu(\Delta \mid D, M_k) \mu(M_k \mid D) \tag{1}$$

where Δ is the quantity of interest, M_i's, $i = 1,...,\kappa$, are the models considered. All the terms in the above equation are also implicitly conditional on the class of models considered. I further assume that the true model is in the class of models considered.

In order to be able to compute the quantities in the above equation, I still need to compute the posterior model probabilities given by

$$\mu(M_k \mid D) = \frac{\mu(D \mid M_k) \mu(M_k)}{\sum_{l} \mu(D \mid M_l) \mu(D \mid M_l)} \tag{2}$$

where

$$\mu(D \mid M_k) = \int_{\Theta} \mu(D \mid \theta_k, M_k) \mu(\theta_k \mid M_k) d\theta_k \tag{3}$$

The posterior mean and variance of the quantity of interest Δ are given by

$$E(\Delta \mid D) = \sum_{k} E(\Delta \mid D, M_k) \mu(M_k \mid D), \tag{4}$$

and

$$Var(\Delta \mid D) = \sum_{k} (Var(\Delta \mid D, M_k) + E^2(\Delta \mid D, M_k)) \mu(M_k \mid D) - (E(\Delta \mid D))^2. \tag{5}$$

I specify a uniform prior over the model space. I adopt a fully Bayesian approach over the model space and the parameter space conditional on the model. I follow Fernandez et al. (2001a) in terms of the statistical model. I refer the reader to those studies which discuss this aspect in greater detail.

4. Data

I employ a dataset based on Hansen and Tarp (2001) as their data allow me to carry out empirical analysis which will be comparable to the prominent studies in the context.

The original data are a panel of 27 variables[2] (including the dependent variable) for 56 countries covering the period 1970 through 1993.

The dependent variable is the average rate of growth during the period covered by the sample. Official development assistance as a share of GDP is the measure of aid flows. The initial level of income and infant mortality rates are also included in the dataset[3].

The number of assassinations per 100,000 and the ethnolinguistic fractionalization index are included to capture the effects of political and social conditions on growth. The ICRGE index of Knack and Keefer (1995) is included to account for institutional variation across countries. A number of human capital proxies are included in the dataset as well. The average years of schooling at primary, secondary and tertiary levels as well as their totals provide us with the data to measure the human capital stock. The logarithm of the average population is included to account for possible scale effects. That is, do countries of (population-wise) different sizes exhibit different growth behavior? Some regional and country dummies and arms imports are included as additional control variables.

First, I transform the data into pure cross-section by calculating the averages of the variables over the period in question except for the initial level of income and initial level of infant mortality variables. I then go on to use that data to run the estimations. In the process, I create higher order terms for aid and policy variables by taking the appropriate powers of aid and the interactions of aid and policy variables. Following the other studies in the literature, I create and use the quadratic form of aid and its interaction with the policy variable. This, in effect, allows one to test whether there is decreasing returns to aid.

5. Results and Discussion

I estimate more parsimonious versions of the BD specifications while accounting for model uncertainty using BMA. One of the criticisms BD has received is the sensitivity of their results to alternative definitions of "policy." Therefore, I experiment with different policy measures as I reexamine the BD results.

The first policy measure employed is an index. It is a weighted average of budget surplus, inflation and the openness index (Sachs and Warner (1995)). As Dalgaard et al. (2004) argue, a single index for policy potentially results in an ambiguous effect of aid on a good policy environment. For instance, if aid flows

[2]The complete list of the variables and their definitions and original sources as well as the list of the countries included in the sample are given in the Appendix.

[3]These variables are always included in the models along with the constant term constituting a benchmark model.

are used to mitigate conflicts through redistribution, worse performance in terms of budget surplus could plausibly translate into higher growth. On the other hand, one would expect that open economies with stable prices exhibit better growth performance, everything else being equal.

The model averaging exercise with the BD policy index gives insignificant estimates for the coefficient of the aid-policy interaction variable. As reported in Table 1, the interaction term has a posterior mean of 0.007. Its posterior standard deviation, however, is too high relative to its mean. One can check the strength of data evidence by looking at the Bayes factors (see Kass and Raftery (1995), Eris (2004) for instance.) Compared to its prior inclusion probability of 0.5, the posterior inclusion probability of the interaction term is too low at 0.087. Hence, the data evidence does not support the inclusion of this variable in the regressions.

In addition to the BD policy index, I experiment with the openness index of Sachs and Warner (1995), inflation, budget surplus, and M2 as a share of GDP. The estimates are essentially very similar to the estimates with the BD policy index[4]. In particular, the openness index which is highly correlated with the BD index yields almost identical results.

It is interesting to note that the coefficient of the aid variable itself is not significant, either. That is, its posterior standard deviation is too high relative to its posterior mean. Also, the posterior inclusion probability is less than its prior inclusion probability of 0.5, which translates into a less than unity Bayes factor.

My findings are in line with the findings of the critics of BD. In particular, I confirm the conclusions drawn by Easterly et al. (2004) which point out the sensitivity of BD results to alternative measures of the variables of interest as well as to different datasets.

Another interesting result is that the aid variable has a negative coefficient despite the fact that it has a relatively large posterior standard deviation and the posterior inclusion probabilities are also too low to warrant the inclusion of the aid variable in the regressions.

[TABLE 1 HERE]

6. Conclusion

The aid-growth nexus has been of great interest and a source of more recent and salient policy debates in the growth literature. Particularly, the question of the importance of the interaction between aid flows and policies followed has crucial consequences. BD investigate this relationship and find a positive relationship between the quality of policies and the efficacy of aid flows. That is, countries

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[4]The estimates are available upon request.

with better institutions and policies do a better job of utilizing foreign aid and transforming foreign help into better growth performance.

This empirical result has been challenged by many, though it is intuitively appealing. A number of studies[5] show that the BD result is not robust. Altering the definitions of the concepts of aid and policy, different samples and time periods and different estimation methods yield different results.

In this paper, I conduct an empirical exercise with the Hansen and Tarp dataset and original BD variables to show that if one accounts for uncertainty regarding model specification, the BD results do not hold up. In other words, the data evidence does not support the claim that there is a robust relationship between good polices and the higher efficacy of aid flows in terms of good growth performance.

This is an important result for the policy makers and international financial institutions, which increasingly favor conditionality and selectivity in the allocation of aid resources. The allocation of aid resources based on the BD result may be especially costly for LDC's in terms of poverty reduction, if some of the aid goes into consumption by the poor. My results also advocate the development of alternative mechanisms for aid as aid flows currently have a dubious effect on the growth performance of the recipients.

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[5]For instance, Hansen and Tarp (2001), Dalgaard et al. (2004), Guillaumont and Chauvet (2001), and Easterly et al. (2004).

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7. APPENDIX

[TABLE 2 HERE]
[TABLE 3 HERE]

Table 1. Posterior estimates with the BD policy index.

Variable	Posterior		
	Mean	**Standard Error**	**Inclusion Probability**
const	0.016	0.024	1.000
oda	-0.018	0.075	0.126
ethnf	-0.001	0.007	0.094
assassin	5E-05	0.003	0.043
icrge	0.005	0.002	0.885
policy	0.008	0.003	0.891
gdi	0.082	0.039	0.721
fdi	0.003	0.290	0.041
mytotl	3E-05	0.002	0.041
armslag	-E-04	2E-04	0.245
lpop	4E-04	0.002	0.131
oda2	-0.008	0.324	0.057
oda*policy	0.007	0.052	0.087
oda2*policy	0.012	0.272	0.058
ssa	-0.018	0.005	0.898
easia	0.001	0.007	0.105
lac	-2E-04	0.005	0.05
cac	-E-04	0.007	0.04
francz	4E-04	0.008	0.059
Egypt	0.01	0.012	0.367

Table 2. The list of countries included in the sample.

Algeria	Indonesia	Tunisia
Argentina	Mali	Turkey
Bolivia	Kenya	Uruguay
Botswana	Korea	Venezuela
Brazil	Madagascar	Zaire
Cameroon	Malawi	Zambia
Chile	Malaysia	Zimbabwe
Colombia	Mexico	Niger
Costa Rica	Morocco	Syrian Arab Republic
Dominican Republic	Nicaragua	Sierra Leone
Ecuador	Nigeria	Somalia
El Salvador	Pakistan	Togo
Ethiopia	Paraguay	Trinidad and Tobago
Ghana	Peru	Gabon
Guatemala	Philippines	Gambia
Haiti	Senegal	Guyana
Honduras	Sri Lanka	Egypt
India	Tanzania	Cote d'Ivoire
Jamaica	Thailand	

Table 3. The list of variables and their original sources.

Variable	Description	Source
growth	Average growth rate of real GDP per capita.	WDI (1997)
lgdppc	Initial level of real GDP per capita	WDI (1997)
oda	Official development assistance as a share of GDP	OECD (1998)
ethnf	Index of ethnolinguistic fractionalization, 1960	Easterly and Levine (1997)
assasin	Number of assassinations per 100,000 population	Easterly and Levine (1997)
icrge	Institutional quality; security of property rights and efficiency of the government bureaucracy	Knack and Keefer (1995)
M2lag	M2 as a share of GDP, lagged one period	Burnside and Dollar (2000)
fiscal	Budget surplus as a share of GDP	Burnside and Dollar (2000)
infl	Log differences of CPI	Burnside and Dollar (2000)
open	Dummy variable for trade openness	Sachs and Warner (1995)
policy	Policy = 1.28 + 6.85 Budget surplus -1.4 Inflation + 2.16 Openness	Burnside and Dollar (2000)
govcon	Government consumption as a share of GDP	Burnside and Dollar (2000)
gdi	Gross domestic investment as a share of GDP	WDI (1997)
fdi	Foreign direct investment as a share of GDP	WDI (1997)
mypr	Mean school years of education at the primary level	Nehru et al. (1995)
mysc	Mean school years of education at the secondary level	Nehru et al. (1995)
mytr	Mean school years of education at the tertiary level	Nehru et al. (1995)
mytotl	Mean school years of education at the primary, secondary, and tertiary level	Nehru et al. (1995)
ssa	Dummy variable for Sub-Saharan Africa	
easia	Dummy variable for East-Asia	
lac	Dummy variable for Latin America	
cac	Dummy variable for Central America	
francz	Dummy variable for Franc Zone	
Egypt	Dummy variable for Egypt	
armslag	Arms imports, lagged one period	Burnside and Dollar (2000)
lpop	log of population	WDI (1997)
imrt	Initial level of infant mortality	WDI (1997)